JPRS: 3082

15 March 1960

FOULING OF SHIPS AND MARITIME INSTALLATIONS ALONG THE SHORES OF THE USSR

/Translation/

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U. S. DEPARTMENT OF COMMERCE
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205 EAST 42ND STREET, SUITE 300
NEW YORK 17, N. Y.

F O R E W O R D

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JPRS: 3082
CSO: 3350-D

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Zoologicheskiy zhurnal
/Zoological Journal/,
Vol 38, No 12, December 1959,
Pages 1886-1887
Russian, per

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Fouling is most apparent in the seas of the USSR. It is diverse both qualitatively and quantitatively, corresponding to differences in the purpose and use of different objects and to the variety of conditions prevailing in the upper "navigation" layer of the seas surrounding the USSR, located as they are in all directions and belonging to three oceans (Table 1).

The principal fouling macroorganisms, making up the greatest volume and weight and being the most important from a hydrodynamic point of view, are given in Table 2. Of hydrodynamic importance are both the size of the wet area and the topography and relief of the latter which determine resistance to the flow of water.

The biological quantity (production) of fouling organisms during a single "fouling season," which varies as to time of onset and termination in the yearly cycle and in total length, will reach, unless protective measures are taken, on a vessel in regular service or in a functioning water pipe a total of 10-20 kilograms per square meter with a thickness of around 10 centimeters, and, during the course of two-four years on such objects or even within a single year on ships or pipes which are relatively non-functioning in the hydrodynamic sense or have an unprotected substrate, this may reach 20-40 or more kilograms per square meter with a thickness of approximately 20-30 centimeters.

The more intensive and regular the operation of the fouled object, the less the number of species of fouling organisms and the more abrupt the reduction in the quantity of the fouling organisms. Both are induced by the hydrodynamic factor involved in operation.

Different operating conditions of ships in different waters and of water pipes require different measures to protect from fouling. Protection against the fouling of water pipes is effected during the warm season by periodic chlorination, flushing with a copper sulfate solution,

or even sometimes by treatment with hot water. The successful use of modern but as yet not very durable barnacle paints is hindered in our country by the extensive and lengthy season of ice which damages the paint coating of the underwater portion of vessels. Ice, on the other hand, also destroys the fouling organisms which have grown during the preceding season.

Recently a start has been made in using a compound system of cathodic protection on steel installations and ships in the Caspian Sea and on medium-sized steel fishing trawlers of the Soviet fishing industry.

As yet no study has been made on the fouling on Soviet ships engaged in coasting or ocean navigation, including expeditionary ships.

TABLE 1

CHARACTERISTICS OF THE UTILIZATION, HYDRODYNAMIC LOAD AND FOULING OF MARITIME OBJECTS AND ANTIFOULING METHODS

Operational Nature of Objects	Ecological Properties of Fouling	Protection Measures
Vessels in constant and rapid motion, strong and constant wave impact and wash of the current	Few varieties. Fouling organisms chemically permanently. Photosynthesis important. Producer - sestonophages. Production approximately 10 kilograms/sq. m. per year.	Anti-fouling paints on a noncorrosive ground. Cathodic protection (tests in nature). Ultrasound (tests in nature with models)
Water pipes (gratings and internal surfaces), wash of flowing water	More species, fastened unstably, mobile ones appear. Photosynthesis difficult (open channels and basins) or impossible (pipes). There are predators and eaters of dead organisms. Production approximately 20 kilograms/sq. m. per year	Periodic chlorination or flushing with copper sulfate. Cathodic or ultrasound protection possible
Vessels moving irregularly and slowly, moderate and irregular wave impact and wash of current	Comparatively many species. Majority of fouling organisms fastened (stably, unstably and by suction) but some are mobile. Producers and consumers. Production app. 20 kilograms/sq. m. per year	
Vessels undergoing major repairs or in storage - wash of current	Many species. Organisms fastened chemically (stably and unstably) and by suction; some are mobile. Photosynthesis exists. Producers and consumers. Production approximately 30 kilograms/sq. m. per year.	Anti-fouling paints worn from previous use. Cathodic protection possible. Ultrasonic protection is probably impractical.

TABLE 1 (CONTINUED)

Operational Nature of Objects	Ecological Properties of Fouling	Protection Measures
Floating lights, buoys, booms, nets, piles, piers, etc., - impact and wash	Very many species. Organisms fastened and mobile. Photosynthesis important. Producers and abundant consumers. Production of the order of 40 kilograms per sq. meter per year and more	As a rule no protection used.

TABLE 2

PRINCIPAL MACROSCOPIC FOULING ORGANISMS IN SEAS OF THE USSR

Organism	Barents	Baltic	Black	Azov	Caspian
Balanus crenatus	+	+			
B. improvisus*		+	+	+	+*
B. eburneus*			+		+*
B. cariosus					
Mytilus edulis	+	+			
M. galloprovincialis			+	+	
Mytilaster lineatus**			+	+	+**
Hydroides spp.	+?				
Pomatoceros triqueter		+?	+		
Cordylophora caspia		+	+	+	+
Laomedea spp.	+	+			
Laminaria spp.	+	+?			
Total	4(5?)	5(7?)	6	4	4

* Introduced into the Caspian in 1955 among the fouling organisms of ships passing from the Black and Azov Seas through the Volga-Don Canal.

** Introduced into the Caspian in the 1920's among the fouling organisms of launches brought by railroad from the Black Sea.

TABLE 2 (CONTINUED)

Organism	Japan	Okhotsk	Bering	East shore of Kamchatka	In how many of the nine seas found
Balanus crenatus	+	+	+	+	6
B. improvisus*					4
B. eburneus*					2
B. cariosus	+	+	+	+	4
Mytilus edulis	+	+	+	+	6
M. galloprovincialis					2
Mytilaster lineatus**					3
Hydroides spp.	+				1(2?)
Pomatoceros triqueter					1(2?)
Cordylophora caspia					4
Laomedea spp.	+	+	+	+	6
Laminaria spp.	+	+	+	+	5(6?)
Total	6	5	5	5	

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